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OBSERVATIONS ON DECORATED WEBS

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The orb web is the characteristic snare constructed by members of the Argiopidae and related families, and also by species in the genus Uloborus in the family Uloboridae. In this country its structure is very uniform, except for minor differences in the number of radii and turns of the sticky spiral, or in the details of the hub, but a familiar exception is the sectorial web of Zygiella. The orb web may, however, be provided with what is often called a "stabilimentum". This name suggests that the structure in some way strengthens the web, but, as this seems most unlikely, the term preferred here is "decoration". The decoration may consist of straight or zigzag ribbons of silk radiating from, or surrounding, the hub. Sometimes the hub is transformed into a central platform of varying degrees of complexity, and this may be combined with the peripheral decoration. Sometimes foreign bodies, such as the pellets formed from the remains of prey wrapped in silk, pieces of vegetable matter or even the egg-cocoons of the spider itself, play a part in the decoration. Many examples were figured by McCook (1893), Hingston (1927 and 1933) and others. In this country decorated webs are unfortunately rare. The only common example is that of Cyclosa conica (Pallas), whose decoration consists of one or two silk bands, often combined with pellets of prey. Uloborus walckenaerius Latr. also has two radial bands arranged in a line, but Argiope bruennichi (Scop.) has one or two zigzag bands.

The main suggestions as to the function of these structures is that they either strengthen the web, or that they serve for the concealment of the spider. To judge from their disposition and relative size, it seems most unlikely that they have any influence on the strength or stability of the web. If their function is protective, there are two ways in which this might be effected. One is by outright concealment. In the web of Uloborus walckenaerius the two bands lie in a straight line. The spider, which is elongated and pale coloured, exactly fills the gap between them and the whole looks like a twig or leaf of dried grass hanging in the web. In the web of Cyclosa conica the spider often appears as one of a row of pellets arranged across the web. On the other hand the bands in the web of Cyclosa are often of plain white silk, and the spider is perfectly obvious.

The other principle of concealment is by distraction of attention. The characteristic decoration in the webs of spiders of the genus Argiope consists of vivid white zigzags radially arranged in the web. Commonly there are four of these forming a cross with diagonal arms. The large, conspicuously-coloured spider sits in the centre with two legs directed towards each zigzag. The suggestion is that this is protective in that it distracts attention from the spider rather than concealing it. To the human eye the whole arrangement is very conspicuous, but it must be borne in mind that the main predators of the Argiopidae are birds and hymenop-

-terous insects. It was interesting to notice, during the study of Argiope argentata (Fab.) described below, three or four clear cases of spiders being taken by birds from webs decorated in this way. The subject of decoration, with special reference to Argiope and Cyclosa, was discussed by Tilquin (1942) together with some experiments on the effect of light and gravity on its orientation. The decoration is well known to be very variable, and it is not surprising that some authorities have concluded that it is of little or no functional significance. Whenever opportunity has offered of observing series of decorated webs, notes have been taken to further the study of this problem. These collected data are presented below.

Argiope bruennichi was studied at Luchon, in the Pyrenees (Marples M.J. 1935). Its decoration consists of one or two conspicuous white radial zigzags, arranged above and below the centre. Out of 90 webs, 29 had no zigzags, 28 had two and 33 a single one below the centre. No example was seen with a single zigzag above the centre, but the other three arrangements were equally represented. A. lobata (Pallas) at Banyuls in the Pyrenees, makes zigzags which are less regular than those of A. bruennichi. Out of 63 webs, 16 had no zigzags, 3 had two and 44 had a single one below the centre.

Cyclosa conica was studied in the New Forest (Marples, B.J. & M.J. 1937). Out of 105 webs 60 had no decoration, 24 had two bands arranged one above and one below the centre, 14 had a single band below and 7 a single band above the centre. The pellets containing the remains of prey are added during the day as they are eaten. Twenty-four webs contained pellets, 15 below, 2 above and 7 both above and below the centre.

The webs of the Uloboridae (Marples, B.J. 1962) tend to lie more or less horizontally. The usual decoration is in the form of narrow radial bands, if two usually in a straight line. Sometimes they are interrupted into a series of short pieces, and sometimes spiral zigzag bands are constructed. Uloborus gibbosus L. Koch in Samoa (Marples, B.J. 1955) is an interesting exception. It is a dark brown spider which spins a horizontal web near the forest floor. There is no decoration. The spider frequently does not sit at the centre of the web in the usual way, and it readily drops to the ground if disturbed. U. plumipes Lucas was studied at Banyuls, in the Pyrenees. Out of 52 webs 16 had no bands, 3 had one, 22 had two, 4 had three and 1 had four. Six had bands and spiral zigzags. U. geniculatus (Olivier) is a large cosmopolitan species which spins a variable web, 50 of which were studied at one place in Samoa. Three had no decoration, 17 had a diametrical band, that is one passing across the centre in a straight line, 9 had a solidly constructed central platform, 19 had both diametrical band and central platform, 1 had a radial band and the central platform, 1 had a diametrical band and also a radial one.

During a visit to Jamaica in November 1968, there was an opportunity to study the decorated webs of Gasteracantha cancriformis (L.) and Argiope argentata on the campus of the University of West Indies at Mona, Kingston. Not only were they common but it was possible to make repeated observations on webs of the same individuals during a period of about three weeks.

The webs of members of the genus Gasteracantha are unique in having white tags or bands of silk dotted along the threads of the guys and framework. The threads of the radii, spiral and hub of the web are not tagged. In a full sized web, some 20 cm. in diameter, the tags are about 10 mm. long, and the gaps between vary from about 15 to 35 mm. The tags are put on when the spider is adding a thread to an existing one. There is the slightest pause or slowing in its progress, and a rapid alternate action of the hind legs combing out the silk. Under the microscope the tag is seen to be a spiral, or set of loops, of very many fine threads, perhaps in two diffuse bundles. When newly made it blows out to the side of the main thread, but tends to stick to it and become less conspicuous as time goes on. In some webs the tags were very numerous and conspicuous, while in others they were very few. Some spiders seemed consistently to make heavily tagged webs, while others did not, but this was not systematically studied. When without a complete web, the spiders often rested at the focus of several tagged threads. When the orb was built these were normally removed, but occasionally a tagged radius remained in the completed orb, and this may be responsible for the few webs noted with abnormal decorations.

Notes were taken of the webs as they were found. Most were in bushes or small trees in fairly open situations. Heights between 1 and 8 feet were recorded; 37 as 3 and 4 feet, 12 below 3 feet and 26 above 4 feet. The plane of the web was vertical, or nearly so, in 33 examples, but 16 were recorded as inclined at 60° , 15 at 45° and 6 as horizontal. The spider usually rested head downwards in the web, but not infrequently it was placed obliquely or even head upwards.

The web may contain a decoration in the form of straight radial bands of white silk. When there was one band, with two exceptions it was below the centre, when there were 2 bands, with two exceptions they were above and below the centre in a straight line. The upper band was short and always continuous, while the lower was longer and frequently in separate pieces. Thirty-seven were entire and 15 were divided into from 2 to 5 pieces. Table 1 shows the variations observed.

	no bands	1 below	1 above	2 bands	3 bands	4 bands	2 above
Webs of 77 individuals.	23	36	2	14	1	1	0
241 webs of 33 individuals.	51	104	11	64	9	0	2

Table 1.

Occasionally, pellets of prey wrapped in silk were placed in the upper band, never in the lower, and once there was a pellet but no band. Eleven webs had pellets, usually only one.

To study the variability of web spinning, 33 webs were observed on more than one occasion during a period of 19 days. Of 206 pairs of successive observations of a web, not always on the following day, 117 showed a change in the web and 89 no change. It is of course possible that the web may not be renewed every day, but there was no way of checking

this. These repeated observations are shown separately in table 2. The lower band was unbroken on 105 occasions and fragmented on 69, while a fragmented upper band was noted three times. Though the details of the web are variable, different individuals appear to have different preferences. Table 2 shows the types of webs constructed by the 10 individuals for whom 10 or more webs were observed during the 19 day period. Of these A, for example, usually had 2 or 1 band, G was usually without bands, while B was very variable and tended to have the unusual condition of 3 bands, or bands above the centre only.

	Number of webs observed.	no bands	1 below	2 bands	3 bands	1 above	2 above
A	18	1	7	10	0	0	0
B	17	3	2	6	2	2	2
C	16	1	7	8	0	0	0
D	13	1	7	2	0	3	0
E	13	2	7	3	0	1	0
F	12	8	3	1	0	0	0
G	12	11	0	1	0	0	0
H	11	0	5	2	3	1	0
I	10	1	6	1	2	0	0
J	10	0	7	3	0	0	0

Table 2.

The common species of Argiope around Kingston was A. argentata, whose webs were usually seen amongst tall grass and herbs, also in bushes. Heights ranging from 1 to 8 feet were recorded for 59 webs, with 33 at 2 and 3 feet, 16 being below and 10 above those levels. The plane of the orb was almost always vertical or nearly so, and the spider always rested at the centre head downwards. The decoration consists of white zigzags, usually 4 arranged in a cross with oblique arms, but the number and their arrangement are variable. The variation was studied by noting the form of the decoration in 65 webs as they were found, and by following daily changes in the web structure of 26 individuals for varying periods during a 19 day interval. These observations are set out in table 3.

	Webs of 65 individuals	244 webs of 26 individuals
No zigzags	16	37
1 zigzag above (ie. in upper half of circle)	0	0
1 below	9	21
2 above	0	0
2 below	2	8
2 diagonal	13	38
2, one above and one below on same side	0	1
3, one above and 2 below	4	27
3, 2 above and 1 below	2	1
4 zigzag	19	111

Table 3.

Of the 10 possible arrangements 2 were never observed. These were the ones with zigzags in the upper half of the circle only; when there were only 3 zigzags the one which was missing was usually an upper one. The preferred arrangements were with 4 zigzags, 2 in a diagonal line or none. One web was seen with 5 zigzags, the extra one being placed vertically below the centre. Occasionally the zigzags were very small, but usually they are much the same size. Now and then a double zigzag occurred, that is one which had another small one lying parallel to it.

The webs of 26 individuals were noted daily as often as possible during a period of 19 days. It was not possible to be certain that a new web was constructed every day, but with one exception this was assumed. The exception was a spider which, on the eighth day of observation, built a web with 4 zigzags, one of them double. This web remained unchanged for 4 successive days, on the last of which the spider was seen sitting beside a moulted skin. Presumably it had not rebuilt its web in the pre-moult period, and possibly occasions when spiders were lost for 3 or 4 days and then reappeared may have been due to moulting. Out of 220 pairs of observations, not always on successive days, 109 showed some change in the web and 111 no change. Table 4 shows the types of webs constructed by 11 individuals seen on 10 or more days during the 19 day observation period. Different spiders seem to have their own type of web.

	Number of webs observed.	No zigzags	1 below	2 below	2 diagonal	3, 1 missing above	4 zigzags
A	18	0	3	0	4	2	9
B	18	0	3	0	6	1	8
C	15	1	0	0	1	0	13
D	14	9	0	3	0	0	2
E	14	11	2	1	0	0	0
F	13	0	0	0	1	3	9
G	13	0	0	0	2	1	10
H	13	0	0	1	1	4	7
I	12	1	4	0	5	2	0
J	11	1	4	0	4	0	2
K	10	0	0	0	2	2	6

Table 4.

An interesting additional structure which may be associated with an orb web, is a tangle of stout threads lying on one or both sides of the plane of the orb. In its fully developed state it fills a volume whose diameter is at least that of the orb, and this is embedded in the centre of it. It occurs in a wide variety of species and is common in the genus Argiope. Out of 45 of the webs of A. argentata 24 had no tangles, 15 had a tangle on one side of the plane of the orb, and 9 had tangles on both sides. The tangle may be interpreted as a protective structure, warning the spider by vibration of the approach of a predator and giving it time to drop. No satisfactory evolutionary forerunner for the orb web has been proposed, but if it did arise from sticky threads in a tangle, such as that constructed by the Theridiidae, the tangle flanking the orb might be a relic of this. Mysmena, in Samoa, (Marples, B.J. 1955, Tamasesia)

which spins a globular web consisting of threads radiating from a point, linked by sticky threads put on from without inwards, seems to be the nearest thing to a three-dimensional orb which we know.

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SPIDERS FROM DEACON HILL, BEDFORDSHIRE

by P.SWANN.

Between the 13th and 24th October 1968, several collections were made from Deacon Hill, Beds. The habitat is typical chalk scarpland and consists almost entirely of short grass with occasional clumps of longer grass; collecting was confined entirely to "grubbing" in these clumps.

CLUBIONIDAE

- Clubiona neglecta O.P-C. ♀♀
C.diversa O.P-C. ♀♀

- Pocadicnemis pumila (Blk.) ♀
Micrargus herbigradus (Blk.) ♂♂
*Erigone atra (Blk.) ♂
Centromerita bicolor (Blk.) ♂

AGELENIDAE

- Hahn timer montana (Blk.) ♀♀

- *C.concinna (Thor.) ♂
Bathyphantes gracilis (Blk.) ♂
Stemonyphantes lineatus (L.) ♂♂
Lepthyphantes tenuis (Blk.) ♀♀

TETRAGNATHIDAE

- Pachygnatha degeeri Sund. ♂♂

- *L.ericaceus (Blk.) ♂
*Linyphia clathrata (Sund.) ♀

LINYPHIIDAE

- Walckenaera acuminata Blk. ♂♂
Wideria antica (Wid.) ♂
Prosopotheca monoceros (Wid.) ♂
*Cornicularia unicornis (O.P-C.) ♀
Gonatium rubens (Blk.) ♂♀

OPILIONES

- *Oligolophus agrestis (Beck.) ♂♂
*Mitopus morio (Fab.) ♂

I am extremely grateful to Mr.D.W.Mackie for determining those species marked with an asterisk, and for checking the others in the above list.
